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# Engineering Abstracts

## ROLLER BEARINGS FOR RAILWAY TRAINS

For many years attempts have been made to produce a roller bearing for trains that would stand up under the heavy duty imposed and meet the severe vertical and side stresses to which all train axle bearings are subjected. Recently, two overland trains of the Chicago, Milwaukee and St. Paul Railroad have been equipped with roller bearings and the bearings are giving complete satisfaction.

The bearing consists of an inner raceway carried on the axle, two sets of tapered rolls carried in two gages or separators, and two outer races. The inner race or cone which is formed in one piece, has ribs at the outer ends and tapers upwardly to a rib in the center. The upper raceway consists of two separate cones. A 5 inch by 9 inch axle has a bearing of the following dimensions: Bore 5 inches; outside diameter  $11\frac{5}{8}$  inches; and width of cone at its contact with the axle  $6\frac{1}{4}$  inches. The capacity of such a bearing is 28,900 pounds vertical and 23,275 pounds thrust load, at 750 revolutions per minute which, with 36 inch wheels, corresponds to 80 miles per hour.

The many tests which have been carried out show that at all speeds below 36.5 miles per hour the resistance due to plain bearings is very much greater than that due to roller bearings.

The following tests were conducted on two cars, loaded equally and in every respect identical with the exception of the bearings. The first test was to determine the relative starting resistances. It was found that the starting ratio between the two cars was 8.8 to one in favor of the roller bearing equipped car; that is, there was a saving in starting of 88.8 per cent. In the acceleration test, each car in turn was hauled by a 300 horse power electric baggage locomotive for a run of 20 seconds. The average acceleration per second, for 15 seconds measured in miles per hour, was .69 for the roller bearings and .57 for the plain bearing car. The direct power saving during the 20 second run ranged from 28 per cent for the first 5 seconds to 18 per cent in 20 seconds. In a test to determine the saving in power consumption made over 28.3 miles of track, there was indicated a power saving of 17.4 per cent in favor of the roller bearing car. In a coasting test on a down grade at the starting point of 0.25 per cent, the roller bearing car started without assistance when the brakes were released, whereas it was necessary to bump the plain bearing car with a locomotive before it would start. The roller bearing car coasted for 7200 feet and the plain bearing car for 1300 feet.

In a test with two gasoline electric trains of the same weight, one with roller bearings and the other with plain bearings, over a distance of about 200 miles, it was found in a total of 26 tests, that the over-all power saving of the roller-bearing train amounted to over 9 per cent on a gross ton-mile basis. The results from the use of roller bearings are so satisfactory, both to the passenger

and the mechanical force of the road, that it will be merely a matter of time until their use will be general on railway equipment.—Scientific American.

## INJECTOR STARTER FOR AIRCRAFT MOTORS

One of the most useful and reliable aircraft accessories now on the market is an injection starter for use in airships, seaplanes, land planes and trucks. This starter has been tested under very severe flying conditions and found so dependable that many leading aircraft manufacturers are now equipping their products with this accessory.

When installed the apparatus is very compact and weighs but 27 pounds. The installation of this starter in any airship eliminates hand starting and cranking, inasmuch as it is operated in the same manner as the starter used in the automobile. The pilot seated in the cockpit of his plane merely presses the button with his toe, and due to the rapid operation of the starter's mechanism, the engine will respond almost instantly.

By applying a mixture of air and gasoline under high pressure to an engine's combustion chambers, the engine is put in motion at 300 to 500 revolutions per minute. The air pressure is substantially equivalent to the explosion pressure. When an engine is running and effects the same action. Starting is practically instantaneous due to the timing of flow of air and gas, and the speed is such that the carburetor of the engine can supply the proper mixture for motor operation.

The equipment comprises a small crank or cam-driven air compressor, a seamless steel tubular tank of about  $6\frac{1}{10}$  cu. ft. capacity, an automatic valve that releases the load from the compressor. When 400 lb. pressure is obtained, a release valve for starting, inlet valves for the cylinders, distributor and copper tubing. The operator by pressing a starter button, releases the compressed air from the tank to the distributor which is timed and rotates with the engine. This distributor divides the air into two paths. The greater portion of the air is conducted to the cylinder that is on its power, there being a tube from the distributor to each cylinder. Entering the cylinder, the air forces the piston downward and the engine's rotation begins.

Simultaneously, the smaller portion of the air and a properly apportioned amount of gasoline goes through a carbureting process and is forced into the cylinder which is on its compression stroke. Ignition takes place when this stroke is complete or slightly past top dead center, with the effect of speeding the rotation already begun by the air. A few revolutions, forced in this way, bring the carburetor quickly into action and starting is complete. Another feature is that the starter while in flight may be used as a super-charger should the pilot need more speed or power.—Aviation.